

# CITIZEN

## SRP-145T

### Scientific Calculator

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# BASIC DEFINITIONS

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## The Keys

To keep your calculator as compact as possible, some keys have more than one function. You can change the function of a key by pressing another key first, or by setting the calculator in a certain mode.

The following pages give you more detailed explanation of each key's use and function.

### 2ndF

#### [SHIFT] Second Function Select Key

Some keys have a second function inscribed above them (for example,  $1/x$  is above  $x^2$ ). To perform this second function, press [SHIFT]. "2F" appears in the display. Then press the key.

**Example:** To calculate the reciprocal of 5, press [5] [SHIFT] [ $1/x$ ]. The display shows 0.2. In this manual, we refer to the key by the desired function. So, the example would be shown as [5] [SHIFT] [ $1/x$ ].

## General Keys

### [0] - [9] [•] Data Entry Keys

Press these keys in their logical sequence to enter numbers.

### [+], [-], [x], [÷], [=] Basic Calculation Keys

Press these keys in their logical sequence for addition, subtraction, multiplication, division, and to display answers.

### [ON/C] Power ON/Clear Key

Press [ON/C] to turn on the calculator and to clear everything except the contents of the memory, constant memory (Ka, Kb), and program memory. It also overrides the auto power-off function.

### [CE] Clear Entry Key

Press [CE] to erase incorrect entries.

### [+/-] Sign Change Key

Press [+/-] to change the displayed number from positive to negative or from negative to positive. If you press [+/-] after pressing [EXP], the sign of the exponent changes.

## Memory Keys

### [MR] Memory Recall Key

Press [MR] to display the contents of the memory.

### [X→M] Memory Store Key

Press [X→M] to store the displayed value into memory. Any previous value in memory is automatically erased.

### [M+] Memory Plus Key

Press [M+] to total the current calculation and add the result to the value already in memory.

## **[SHIFT] [Ka $\leftrightarrow$ k], [SHIFT] [Kb $\leftrightarrow$ k] Constant (Ka, Kb) Memory Store Key**

Press to enter the displayed value into constant memory Ka or Kb.

## **[Ka $\leftrightarrow$ k], [Kb $\leftrightarrow$ k] Constant (Ka, Kb) Memory Recall Key**

Press to display the contents of a constant memory.

### **Notes:**

- Constant memories Ka and Kb can have a value of 0.
- If you press **[Ka $\leftrightarrow$ k]** or **[Kb $\leftrightarrow$ k]** after entering a number or making a calculation, the displayed value is multiplied by the value in Ka or Kb.

## **Special Keys**

### **[ ( ), [ ) ] Parenthesis Keys**

This calculator uses true algebraic logic. It performs calculations using the following priority:

- 1) Functions
- 2) Calculations in parenthesis
- 3) Power and root calculations
- 4) Multiplication and division
- 5) Addition and subtraction

To change this order, enclose the expressions that must be calculated first within [ ( ) and [ ) ]. In a single expression, you can use a maximum of 42 nested parentheses at 6 levels (nesting of up to 7 parentheses in one level).

For example, if you press **[–] 6 [x<sup>2</sup>] [=]**, the calculator gives a result of –36. This might seem incorrect at first, since the square of a negative number is always positive. However, if you refer to the above priority sequence, you see that the power ([x<sup>2</sup>]) has a higher priority than the minus ([–]). So the calculator sees the entry as “the negative of six squared.” To make the calculator perform “negative six, squared” enter **[ ( ) [–] 6 [ ) ] [x<sup>2</sup>] [=]**. This forces the calculator to resolve the **[–] 6** and then square the result.

### **[EXP] Exponent Key**

To enter a number in scientific notation, first enter the numbers for the mantissa, press **[EXP]**, and then enter the numbers for the exponent.

### **[SHIFT] [ $\pi$ ] Key**

Press **[SHIFT] [  $\pi$  ]** to display the value of  $\pi$ , which is the ratio of a circle’s circumference to its diameter (approximately 3.141592654).

### **[SHIFT] [→° ’ ”], [SHIFT] [° ’ ”→] Sexagesimal notation/decimal notation conversion Keys**

To change from sexagesimal (base 60) notation (degree, minute, second) to decimal notation (degree) press **[SHIFT] [° ’ ”→]**. To change from decimal notation to sexagesimal notation, enter the number in decimal form and then press **[SHIFT] [→° ’ ”]**.

## **[SHIFT] [X↔Y] Register Exchange Key**

Press **[SHIFT] [X↔Y]** to exchange the displayed value (X-register) with the contents of the working register (Y-register).

## **[SHIFT] [FIX] Decimal Point Set Key**

Use to set the number of digits displayed after the decimal point in either final or intermediate results. The calculator continues to use its full range for internal calculations, and only rounds the number in the display.

### **[SHIFT] [FIX] [0] - [6]**

Sets the number of digits to be displayed to the right of decimal point.

### **[SHIFT] [FIX] [7], [8], [9], [•]**

Selects floating point format.

**Note:** **[SHIFT] [FIX]** is inactive immediately after and during numerical input.

**[DRG]** Pressing this key will change the mode of angle unit sequentially → DEG → RAD → GRAD and display it on LCD.

**[OFF]** Power off key

## **Function Keys**

### **[sin], [cos], [tan] Sine, Cosine, Tangent Keys**

Calculate the trigonometric functions of the displayed value.

### **[SHIFT] [sin<sup>-1</sup>], [SHIFT] [cos<sup>-1</sup>], [SHIFT] [tan<sup>-1</sup>]**

### **Arc Sine, Arc Cosine, Arc Tangent Keys**

Calculate the inverse trigonometric functions of the displayed value.

### **[SHIFT] [HYP] [sin], [SHIFT] [HYP] [cos], [SHIFT] [HYP] [tan] Hyperbolic Keys**

Calculate the hyperbolic functions of the displayed value.

### **[SHIFT] [HYP] [SHIFT] [sin<sup>-1</sup>], [SHIFT] [HYP] [SHIFT] [cos<sup>-1</sup>], [SHIFT] [HYP] [SHIFT] [tan<sup>-1</sup>]**

### **Inverse Hyperbolic Keys**

Calculate inverse hyperbolic functions of the displayed value.

### **[Log], [SHIFT] [10<sup>x</sup>] Common Logarithm and Common Antilogarithm Keys**

Calculate the common logarithm of the displayed value. To calculate the common antilogarithm of the displayed value, press **[SHIFT] [10<sup>x</sup>]**.

### **[ln], [SHIFT] [e<sup>x</sup>] Natural Logarithm and Natural Antilogarithm Keys**

To calculate the natural logarithm of the displayed value, press **[ln]**. To calculate the natural antilogarithm of the displayed value (to raise e (2.718281828) to x powers), press **[SHIFT] [e<sup>x</sup>]**.

### **[√], [x<sup>2</sup>] Square Root and Square Keys**

Press [  $\sqrt{\phantom{x}}$  ] to find the square root of the displayed value. To square the displayed value, press [  $x^2$  ].

### [SCI] Scientific Key

Converts the displayed number into a power of ten and back.

Example:	You Press	You See
	12.3456 x 10 =	123.456
	SCI	1.23456 02
	SCI	123.456
	SCI	1.23456 02

### [SHIFT] [ $\sqrt[3]{\phantom{x}}$ ] Cubic Root Key

Press [SHIFT] [  $\sqrt[3]{\phantom{x}}$  ] to find the cubic root of the displayed value.

### [SHIFT] [1/x] Reciprocal Key

Press [SHIFT] [1/x] to calculate the reciprocal of the displayed value.

### [SHIFT] [x!] Factorial Key

To find the factorial of the displayed value, press [SHIFT] [x!].

**Example:** 4! = 4 x 3 x 2 x 1 = 24

### [X<sup>y</sup>] Power Key

Press any number [X], [X<sup>y</sup>], any number [y], and [=] to raise X to the y power.

**Example:** 5 [X<sup>y</sup>] 4 [=] 625

### [SHIFT] [ $\sqrt[y]{\phantom{x}}$ ] Root Key

Press any number [x] [SHIFT] [  $\sqrt[y]{\phantom{x}}$  ], any number [y], and [=] to display the y root x.

**Example:** 625 [SHIFT] [  $\sqrt[y]{\phantom{x}}$  ] 4 [=] 5

## Programming Keys (Use in the PGM mode only)

### [SHIFT] [PGM] – Program Mode Set and Clear Key.

Set the calculator to the learn program mode. **PGM** appears on the display and the previous contents of program memory is cleared.

When you finish entering the program, press [SHIFT] [PGM]. The program you just entered is stored in the program memory. **PGM** disappears and the calculator exits the program mode.

### [RUN] – Compute Key

Runs the recorded program.

### [SHIFT] [[x]] – Specify Variable Key

Lets you have the calculator wait for an entry during a program.

### [SHIFT] [HALT] – Temporarily Halt Calculation Key

Temporarily halts a program so you can view the intermediate results or interrupt calculations.

## Statistical Keys (Use in the SD mode only)

### [SHIFT] [SD] Statistical Mode Select Key

Sets the calculator to the statistical calculation mode. SD appears on the display.

### [SHIFT] [CAD] Statistical Register Clear Key

Clears the statistical calculation registers.

### [DATA], [DEL] Data Entry and Delete Key

In the SD mode, enter data by pressing the desired numbers, then [DATA]. If you enter incorrect data and do not notice your mistake until you press [DATA], enter the same incorrect data and then press [DEL] to delete that incorrect data.

### [ $\bar{x}$ ] Arithmetic Mean Key

Calculates the arithmetic mean ( $\bar{x}$ ) of the data.

### [SHIFT] [ $\sigma_n$ ] Population Standard Deviation Key

Calculates the population standard deviation ( $\sigma_n$ ) of the data.

### [ $\sigma_{n-1}$ ] Sample Standard Deviation Key

Calculates the sample standard deviation ( $\sigma_{n-1}$ ) of the data.

### [SHIFT] [ $\Sigma x^2$ ] Sum of Square Value Key

Calculates the sum of the square value ( $\Sigma x^2$ ) of the data.

### [SHIFT] [ $\Sigma x$ ] Sum of Values Key

Calculates the sum of the value ( $\Sigma x$ ) of the data.

### [n] Number of Data Key

Displays the number of data (n) entries.

## The Display

The display shows entered numbers, interim results, and calculation results.

Floating point displays up to 10 digits.

The mantissa section displays up to 8 digits. The exponent section displays up to  $\pm 99$ .

**SD** : Indicates the statistical mode.

**M** : Indicates that a value is stored in memory.

**-** : Appears to the left of the mantissa or exponent to indicate that the respective value is negative.

**E** : Indicates an error.

**PGM** : Indicates the program learn mode.

**GRAD** : Indicates that gradient units have been selected.

**RAD** : Indicates that radian units have been selected.

**DEG** : Indicates that degree units have been selected.

**2F** : Appears when the second function has been selected.

- HYP** : Appears when the hyperbolic function has been selected.
- (** : Appears when you press **[ ( ]**. It shows the present level of nesting.
- ( | )** : Appears when you press **[SHIFT] [[x]]** in the program learn mode and when program execution halts to let you enter a variable. The number in brackets shows the number of the place of the variable, and goes from 1 - 40.

## OVERFLOW OR ERROR CHECK

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An overflow or error is indicated by "**E**". Stop further calculations.

An overflow or error occurs when:

- An intermediate or final calculation result exceeds  $1 \times 10^{100}$  (including memory calculations).
- You try to divide by zero.
- The number of low priority storage levels exceeds 6 in a parentheses calculation or nesting parentheses exceed 7 in one level. (Even if the number of levels is within 6, an error might occur if you are using memories **Ka** or **Kb**, or program memories.)
- You try to use **[SHIFT] [Ka<sup>x→k</sup>]** or **[SHIFT] [Kb<sup>x→k</sup>]** while memories **Ka** and **Kb** are being used for low-priority calculation storage.
- You make a calculation that is out of the range for functional and statistical calculations.
- You try to store over 40 steps in a program.

To clear calculations after an overflow condition, press **[ON/C]**.

### Memory Protection:

Memory contents are protected against overflow or error conditions. If a memory operation would result in the memory value exceeding  $1 \times 10^{100}$ , the calculator displays **⌘** and does not change the value in memory.

## REPLACING THE BATTERIES

Your calculator is powered by two alkaline-manganese batteries. When the display dims, replace the batteries.

- Unscrew the two screws on the back of the calculator.
- Insert a flat bladed screwdriver into the slot between the upper and lower case then carefully twist it to separate the case.
- Remove both batteries and dispose of them promptly. Never allow children to play with batteries.
- Wipe off the new batteries with a dry cloth to maintain good contact.
- Insert the two new batteries with their flat sides (plus terminals) up.
- Align the upper and lower cases then snap them to close together.

7. Tighten the screws.

# BASIC OPERATION

## TURNING ON THE CALCULATOR

Press [ON/C] to turn on your calculator. A " 0 " shows on the display. If you leave your calculator on without making any calculation, it automatically turns itself off in approximately 10 minutes to save battery life.

**Note:** Even when the power is off, the calculator's memory retains the contents of the independent memory, constant memory registers, and any program steps.

## Normal Calculations

- The calculator operates using true algebraic logic; calculations can be performed in the same sequence as the written formula.
- You can nest up to 42 parentheses at 6 levels, with up to 7 parentheses in one level.

## Four Basic Calculations (Including Parenthesis Calculations)

<b>Example:</b> $7 \times 8 - 4 \times 5 (= 56 - 20) = 36$		
Press	Display	Comment
[7]	DEG 7.	Enter value
[x]	DEG 7.	Enter operation
[8]	DEG 8.	Enter value to operate by
[-]	DEG 56.	Enter operation, show result
[4]	DEG 4.	Enter value to operate by
[x]	DEG 4.	Enter operation
[5]	DEG 5.	Enter value to operate by
[=]	DEG 36.	Enter operation, show result
<b>Example:</b> $2 \times [ 7 + 6 \times (5 + 4) ] = 122$		
Press	Display	Comment



[2]	DEG 2.	Enter value
[x]	DEG 2.	Enter operation
[ ( ]	DEG (	Enter operation, show symbol
[7]	DEG 7.	Enter value to operate by
[+]	DEG 7.	Enter operation
[6]	DEG 6.	Enter value to operate by
[x]	DEG 6.	Enter operation
[ ( ]	DEG ((	Enter operation, show symbol
[5]	DEG 5.	Enter value to operate by
[+]	DEG 5.	Enter operation
[4]	DEG 4.	Enter value to operate by
[=]	DEG 122.	Enter operation, show result
<ul style="list-style-type: none"> <li>It is unnecessary to press the [ ) ] key before the [=] key</li> </ul>		

## Constant Calculations

<b>Example:</b> $3 + \underline{2.3} = 5.3$ $6 + \underline{2.3} = 8.3$		
Press	Display	Comment
[3]	DEG 3.	Enter value
[+]	DEG 3.	Enter operation
[2] [•] [3]	DEG 2.3	Enter value to operate by
[=]	DEG 5.3	Enter operation, show result
[6]	DEG 6.	Enter value to operate by
[=]	DEG 8.3	Enter operation, show result
<b>Example:</b> $7 - \underline{5.6} = 1.4$ $-4.5 - \underline{5.6} = -10.1$		
Press	Display	Comment

[7]	DEG 7.	Enter value
[−]	DEG 7.	Enter operation
[5] [•] [6]	DEG 5.6	Enter value to operate by
[=]	DEG 1.4	Enter operation, show result
[4] [•] [5]	DEG 4.5	Enter value to operate by
[+/-]	DEG −4.5	Enter operation, show result
[=]	DEG −10.1	Enter operation, show result

**Example:**  $2.3 \times 12 = 27.6$        $-9 \times 12 = -108$

Press	Display	Comment
[1] [2]	DEG 12.	Enter value
[x]	DEG 12.	Enter operation
[2] [•] [3]	DEG 2.3	Enter value to operate by
[=]	DEG 27.6	Enter operation, show result
[9]	DEG 9.	Enter value to operate by
[+/-]	DEG −9.	Enter operation, show result
[=]	DEG −108.	Enter operation, show result

**Example:**  $74 \div 2.5 = 29.6$        $85.2 \div 2.5 = 34.08$

Press	Display	Comment
[7] [4]	DEG 74.	Enter value
[ ÷ ]	DEG 74.	Enter operation
[2] [•] [5]	DEG 2.5	Enter value to operate by
[=]	DEG 29.6	Enter operation, show result
[8] [5] [•] [2]	DEG 85.2	Enter value to operate by
[=]	DEG 34.08	Enter operation, show result

# Memory Calculations

## Notes:

- Do not set the function mode to "SD" when performing memory calculations.
- A new number entered into memory by pressing **[X→M]** replaces any number previously stored.
- To clear the memory's contents, press **[0] [X→M]** or **[ON/C] [X→M]** in sequence.
- **M** appears when a number beside "0" is stored in memory.
- When you press **[SHIFT] [X→M]** after pressing **[MR]**, the displayed number is exchanged with the contents of the memory.

<b>Example:</b> $7 + 7 - 7 + (2 \times 3) + (2 \times 3) + (2 \times 3) - (2 \times 3) = 19$		
Press	Display	Comment
[7]	DEG 7.	Enter value
[X→M]	M DEG 7.	Enter operation, show symbol
[M+]	M DEG 7.	Enter operation
[+/-]	M DEG -7.	Enter operation, show result
[M+]	M DEG -7.	Enter operation
[2]	M DEG 2.	Enter value
[x]	M DEG 2.	Enter operation
[3]	M DEG 3.	Enter value to operate by
[M+]	M DEG 6.	Enter operation, show result
[M+]	M DEG 6.	Enter operation
[M+]	M DEG 6.	Enter operation
[+/-]	M DEG -6.	Enter operation, show result
[M+]	M DEG -6.	Enter operation
[MR]	M DEG 19.	Enter operation, show result

- When the **[SHIFT] [X→M]** keys are pressed after the **[MR]** key, the displayed number is exchanged with the contents of the memory.

## Function Calculations

### Notes:

- This calculator computes  $\pi = 3.141592654$  and  $e = 2.718281829$ .
- In some scientific functions, the display disappears momentarily while the calculator processes complicated formulas. Do not enter numbers or press function keys while this occurs.

### Sexagesimal ↔ Decimal Conversion

The **[SHIFT] [° ' "→]** key converts a sexagesimal figure expressed in degrees, minutes and seconds to decimal notation. Pressing **[SHIFT] [→° ' "]** converts a decimal notation back to a sexagesimal notation.

<b>Example:</b> $14^{\circ}25'36'' = 14.42666667^{\circ}$		
Press	Display	Comment
<b>[1] [4] [°] [2] [5] [3] [6]</b>	DEG 14.2536	Enter value
<b>[SHIFT]</b>	DEG <b>2F</b>	Enter operation, show symbol
<b>[°, "→]</b>	DEG 14.42666667	Enter operation, show result

### Trigonometric/Inverse Trigonometric Functions

<b>Example:</b> $2 \cdot \sin 45^{\circ} \times \cos 65^{\circ} = 0.597672477$		
Press	Display	Comment
<b>[ON/C]</b>	DEG 0.	Enter operation, show symbol
<b>[2]</b>	DEG 2.	Enter value
<b>[x]</b>	DEG 2.	Enter operation
<b>[4] [5]</b>	DEG 45.	Enter value to operate by
<b>[sin]</b>	DEG 0.707106781	Enter operation, show result
<b>[x]</b>	DEG 1.414213562	Enter operation, show result
<b>[6] [5]</b>	DEG 65.	Enter value to operate by
<b>[cos]</b>	DEG 0.422618262	Enter operation, show result

[=]	DEG 0.597672477	Enter operation, show result
<b>Example:</b> $\sin^{-1} 0.8 - \cos^{-1} 0.9 = 27^{\circ}17'17.41''$		
Press	Display	Comment
[•] [8]	DEG 0.8	Enter value
[SHIFT]	DEG <b>2F</b>	Enter operation, show symbol
[sin <sup>-1</sup> ]	DEG 53.13010235	Enter operation, show result
[-]	DEG 53.13010235	Enter operation
[•] [9]	DEG 0.9	Enter value to operate by
[SHIFT]	DEG <b>2F</b>	Enter operation, show symbol
[cos <sup>-1</sup> ]	DEG 25.84193276	Enter operation, show result
[=]	DEG 27.28816959	Enter operation, show result
[SHIFT]	DEG <b>2F</b>	Enter operation, show symbol
[→°, ”]	DEG 27.17174105	Enter operation, show result

## Hyperbolic Functions and Inverse Hyperbolic Functions

<b>Example:</b> $\cosh 1.5 - \sinh 1.5 = 0.22313016 = e^{-1.5}$		
Press	Display	Comment
[1] [•] [5]	DEG 1.5	Enter value
[X→M]	M DEG 1.5	Enter operation, show symbol
[SHIFT]	M <b>2F</b> DEG	Enter operation, show symbol
[HYP]	M <b>HYP</b> DEG	Enter operation, show symbol
[cos]	M 2.352409615 DEG	Enter operation, show result
[-]	M 2.352409615 DEG	Enter operation
[MR]	M DEG 1.5	Enter operation, show result

[SHIFT]	M 2F	DEG	Enter operation, show symbol
[HYP]	M HYP	DEG	Enter operation, show symbol
[sin]	M 2.129279455	DEG	Enter operation, show result
[=]	M 0.22313016	DEG	Enter operation, show result
[ln]	M -1.5	DEG	Enter operation, show result

**Example:**  $\sinh^{-1} 2 \times \cosh^{-1} 1.5 = 1.389388924$

Press	Display	Comment
[2]	DEG 2.	Enter value
[SHIFT]	2F	Enter operation, show symbol
[HYP]	HYP	Enter operation, show symbol
[SHIFT]	HYP 2F	Enter operation, show symbol
[sin <sup>-1</sup> ]	DEG 1.443635475	Enter operation, show result
[x]	DEG 1.443635475	Enter operation
[1] [•] [5]	DEG 1.5	Enter value to operate by
[SHIFT]	2F	Enter operation, show symbol
[HYP]	HYP	Enter operation, show symbol
[SHIFT]	HYP 2F	Enter operation, show symbol
[cos <sup>-1</sup> ]	DEG 0.96242365	Enter operation, show result
[=]	DEG 1.389388924	Enter operation, show result

## Common and Natural Logarithms/Exponentiations

(Common Antilogarithms, Natural Antilogarithms, Powers, and Roots)

**Example:**  $\log 456 \div \ln 456 = 0.434294482$

Press	Display	Comment
-------	---------	---------

[4] [5] [6]	DEG 456.	Enter value
[X→M]	M DEG 456.	Enter operation, show symbol
[Log]	M DEG 2.658964843	Enter operation, show result
[ ÷ ]	M DEG 2.658964843	Enter operation
[MR]	M DEG 456.	Enter operation, show result
[ln]	M DEG 6.12249281	Enter operation, show result
[=]	M DEG 0.434294482	Enter operation, show result

**Example:**  $10^{0.4} + [5 \times e^{-3}] = 2.760821773$

Press	Display	Comment
[.] [4]	DEG 0.4	Enter value
[SHIFT]	DEG <b>2F</b>	Enter operation, show symbol
[10 <sup>x</sup> ]	DEG 2.511886432	Enter operation, show result
[+]	DEG 2.511886432	Enter operation
[5]	DEG 5.	Enter value to operate by
[x]	DEG 5.	Enter operation
[3]	DEG 3.	Enter value to operate by
[+/-]	DEG -3.	Enter operation, show result
[SHIFT]	DEG <b>2F</b>	Enter operation, show symbol
[e <sup>x</sup> ]	DEG 0.049787068	Enter operation, show result
[=]	DEG 2.760821773	Enter operation, show result

**Example:**  $3^{12} + e^{10} = 553467.4658$

Press	Display	Comment
[3]	DEG 3.	Enter value
[X <sup>y</sup> ]	DEG 3.	Enter operation

[1] [2]	DEG 12.	Enter value to operate by
[+]	DEG 531441.	Enter operation, show result
[1] [0]	DEG 10.	Enter value to operate by
[SHIFT]	DEG <b>2F</b>	Enter operation, show symbol
[e <sup>x</sup> ]	DEG 22026.4658	Enter operation, show result
[=]	DEG 553467.4658	Enter operation, show result

## Square Roots, Cube Roots, Squares, Reciprocals, and Factorials

<b>Example:</b> $\sqrt{2} + \sqrt{3} \times \sqrt{5} = 5.287196909$		
Press	Display	Comment
[2]	DEG 2.	Enter value
[ $\sqrt{\phantom{x}}$ ]	DEG 1.414213562	Enter operation, show result
[+]	DEG 1.414213562	Enter operation
[3]	DEG 3.	Enter value to operate by
[ $\sqrt{\phantom{x}}$ ]	DEG 1.732050808	Enter operation, show result
[x]	DEG 1.732050808	Enter operation
[5]	DEG 5.	Enter value to operate by
[ $\sqrt{\phantom{x}}$ ]	DEG 2.236067978	Enter operation, show result
[=]	DEG 5.287196909	Enter operation, show result
<b>Example:</b> $\sqrt[3]{5} + \sqrt[3]{-27} = -1.290024053$		
Press	Display	Comment
[5]	DEG 5.	Enter value
[SHIFT]	DEG <b>2F</b>	Enter operation, show symbol
[ $\sqrt[3]{\phantom{x}}$ ]	DEG 1.709975947	Enter operation, show result



[+]	DEG 1.709975947	Enter operation
[2] [7]	DEG 27.	Enter value to operate by
[+/-]	DEG -27.	Enter operation, show result
[SHIFT]	DEG <b>2F</b>	Enter operation, show symbol
[ $\sqrt[3]{\phantom{x}}$ ]	DEG -3.	Enter operation, show result
[=]	DEG -1.290024053	Enter operation, show result

**Example:** 
$$\frac{1}{\frac{1}{3} - \frac{1}{4}} = 12$$

Press	Display	Comment
[3]	DEG 3.	Enter value
[SHIFT]	DEG <b>2F</b>	Enter operation, show symbol
[1/x]	DEG 0.333333333	Enter operation, show result
[-]	DEG 0.333333333	Enter operation
[4]	DEG 4.	Enter value
[SHIFT]	DEG <b>2F</b>	Enter operation, show symbol
[1/x]	DEG 0.25	Enter operation, show result
[=]	DEG 0.083333333	Enter operation, show result
[SHIFT]	DEG <b>2F</b>	Enter operation, show symbol
[1/x]	DEG 12.	Enter operation, show result

**Example:**  $123 + 30^2 = 1023$

Press	Display	Comment
[1] [2] [3]	DEG 123.	Enter value
[+]	DEG 123.	Enter operation
[3] [0]	DEG 30.	Enter value to operate by

[x <sup>2</sup> ]	DEG 900.	Enter operation, show result
[=]	DEG 1023.	Enter operation, show result
<b>Example:</b> 8! (= 1 x 2 x 3 x ..... x 7 x 8) = 40320		
Press	Display	Comment
[8]	DEG 8.	Enter value
[SHIFT]	DEG <b>2F</b>	Enter operation, show symbol
[x!]	DEG 40320.	Enter operation, show result

# STANDARD DEVIATIONS

- Press **[SHIFT] [SD]** to set the calculator to the statistical calculation mode.
- Press **[SHIFT] [CAD]** to clear statistical memory before you start a new calculation.

<b>Example:</b> Find n, $\Sigma x^2$ , $\Sigma x$ , $\bar{x}$ , $\sigma^{n-1}$ , and $\sigma^n$ based on the data: 2, 2, 2, 3, 4, 4, 7, 8, 9		
Press	Display	Comment
[SHIFT] [SD]	SD DEG 0.	Set to statistical mode
[SHIFT] [CAD]	SD DEG 0.	Clear all data
[2] [x] [3] [DATA]	SD DEG 3.	Enter data 1, 2, 3 (Value: 2)
[3] [DATA]	SD DEG 4.	Enter data 4 (Value: 3)
[4] [x] [2] [DATA]	SD DEG 6.	Enter data 5, 6 (Value: 4)
[5] [DATA]	SD DEG 7.	Enter data 7 (Value: 5)
[DEL]	SD DEG 6.	Cancel data 7
[7] [DATA]	SD DEG 7.	Enter data 7 (Value: 7)
[8] [DATA]	SD DEG 8.	Enter data 8 (Value: 8)
[9] [DATA]	SD DEG 9.	Enter data 9 (Value: 9)
[n]	SD DEG 9.	Number of data

[SHIFT] [Σx <sup>2</sup> ]	SD	DEG 247.	Sum of square value
[SHIFT] [Σx]	SD	DEG 41.	Sum of value
[ $\bar{x}$ ]	SD	DEG 4.555555556	Arithmetical mean
[σ <sub>n-1</sub> ]	SD	DEG 2.743679606	Sample standard deviation
[SHIFT] [σ <sub>n</sub> ]	SD	DEG 2.586765939	Population standard deviation
[SHIFT] [SD]	SD	DEG 2.586765939	Back to normal mode
[ON/C]	SD	DEG 0.	Clear display

**Notes:**

The sample standard deviation σ<sub>n-1</sub> is defined as

$$\sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n - 1}}$$

The population standard deviation σ<sub>n</sub> is defined as

$$\sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n}}$$

The arithmetical mean x is defined as

$$\frac{\Sigma x}{n}$$

- You do not have to press σ<sub>n</sub>, σ<sub>n-1</sub>,  $\bar{x}$ , n, Σx or Σx<sup>2</sup> in any particular sequence.
- To delete an incorrect entry, press [DEL].

# PROGRAMMING

## Storing Mathematical Procedures

With your Programmable Scientific Calculator, complex repeated calculations are no longer time-consuming chores. All you have to do is tell the calculator what you want to do in a way it can understand (in other words, program it).

Your calculator can store one procedure with up to 40 steps. These "steps" can be either steps (like mathematical functions) or characters (like numbers). Each function counts as one step. It remembers the procedure even after you turn off the calculator. You can have more than one variable in your calculation.

Your calculator learns mathematical procedures or programs in the Program (PGM) Mode. To set the calculator to the Program Mode, press **[SHIFT] [PGM]**. **PGM** appears on the display.

Now enter your procedure as if you were just going to calculate it once - except - press **[SHIFT] [[x]]** before entering variable data. You get your first answer while you are still in the PGM mode.

**Note:** If you press **[SHIFT] [[x]]** then **[ • ]** or a number, and then **[EXP]**, **[+/-]**, **[ ]** or **[CE]**, both the number and the first function following the number are treated as one variable - they are not written into the program as steps.

Remember, you can enter a maximum of 40 steps. If you try to enter a 41st step, the calculator displays **⌘**. Press **[ON/C]** to clear the error.

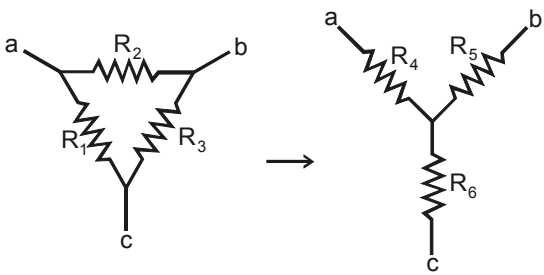
To stop storing a program, press **[SHIFT] [PGM]** again. **PGM** disappears and the calculator leaves the program mode. Press **[RUN]** to begin repeating the same mathematical procedure with different variables.

When you press **[RUN]**, you can begin entering different variables. Just enter each variable in the order in which it occurs in the formula and press **[RUN]** after each variable. The answer appears on the display.

Stored programs are automatically erased when you press **[SHIFT] [PGM]**. So, unless you want to enter a new program, do not select the program mode.

You can program your calculator to give you interim values in your formula also. While programming the calculator (in PGM mode), press **[=]** when you reach the point where you want the interim value displayed. Then press **[SHIFT] [HALT]** and continue entering your formula in the usual way.

When you run the program, press **[RUN]** after the calculator displays an interim value to resume the program. You can use the same method to program your calculator to run two or more formulas, one after another.

PROGRAM SHEET			
<b>Program:</b> $\Delta \rightarrow Y$ transformation			
<b>Description:</b> <div style="display: flex; align-items: center; justify-content: space-around;">  <div> <math>\Delta \rightarrow Y</math> <math display="block">R_4 = \frac{R_1 \cdot R_2}{R_1 + R_2 + R_3}</math> <math display="block">R_5 = \frac{R_2 \cdot R_3}{R_1 + R_2 + R_3}</math> <math display="block">R_6 = \frac{R_3 \cdot R_1}{R_1 + R_2 + R_3}</math> </div> </div>			
<b>Example:</b> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div> <math>R_1 = 12 (\Omega)</math>  <math>R_2 = 47 (\Omega)</math>  <math>R_3 = 82 (\Omega)</math> </div> <div> <math>R_1 = 10 (\Omega)</math>  <math>R_2 = 20 (\Omega)</math>  <math>R_3 = 30 (\Omega)</math> </div> </div>			
Step	Key Operation	Display	Comment
1	[1] [2] [SHIFT] [Ka <sup>X→K</sup> ]	DEG 12.	R <sub>1</sub> into Ka reg.
2	[4] [7] [SHIFT] [Kb <sup>X→K</sup> ]	DEG 47.	R <sub>2</sub> into Kb reg.
3	[8] [2] [X→M]	M DEG 82.	R <sub>3</sub> into memory
4	[SHIFT] [PGM]	M PGM DEG 0.	Clear program memory
5	[Ka <sup>X→K</sup> ]	M PGM DEG 12.	Recall R <sub>1</sub>
6	[Kb <sup>X→K</sup> ]	M PGM DEG 564.	R <sub>1</sub> x R <sub>2</sub>
7	[ ÷ ] [ ( ]	M PGM ( DEG	Parenthesis
8	[Ka <sup>X→K</sup> ] [+]	M PGM DEG 12.	Recall R <sub>1</sub>
9	[Kb <sup>X→K</sup> ] [+]	M PGM DEG 59.	R <sub>1</sub> + R <sub>2</sub>
10	[MR] [ ) ] [=]	M PGM DEG 4.	R <sub>4</sub>
11	[SHIFT] [HALT]	M PGM DEG 4.	Halt
12	[MR]	M PGM DEG 82.	Recall R <sub>3</sub>

13	[Kb <sup>X→K</sup> ]	M PGM DEG 3854.	R <sub>3</sub> x R <sub>2</sub>
14	[=]	M PGM DEG 27.33333333	R <sub>5</sub>
15	[SHIFT] [HALT]	M PGM DEG 27.33333333	Halt
16	[MR]	M PGM DEG 82.	Recall R <sub>3</sub>
17	[Ka <sup>X→K</sup> ]	M PGM DEG 984.	R <sub>3</sub> x R <sub>1</sub>
18	[=]	M PGM DEG 6.978723404	R <sub>6</sub>
19	[SHIFT] [PGM]	M DEG 0.	
20	[1] [0] [SHIFT] [Ka <sup>X→K</sup> ]	M DEG 10.	Set R <sub>1</sub> = 10 (Ω)
21	[2] [0] [SHIFT] [Kb <sup>X→K</sup> ]	M DEG 20.	Set R <sub>2</sub> = 20 (Ω)
22	[3] [0] [X→M]	M DEG 30.	Set R <sub>3</sub> = 30 (Ω)
23	[ON/C] [RUN]	M DEG 3.33333333	R <sub>4</sub>
24	[RUN]	M DEG 10.	R <sub>5</sub>
25	[RUN]	M DEG 5.	R <sub>6</sub>

PROGRAM SHEET			
Program:		Total amount	
Description: Find the total amount of principal and interest on a \$5,000 loan (x) at 6% annual interest (y) compounded annually over a period of 7 years (z)? Formula : total amount = $x (1 + y)^z$			
Example: <div>(1) x = \$5,000 y = 6% z = 7 years</div> <div>(2) x = \$1,000 y = 10% z = 5 years</div>			
Step	Key Operation	Display	Comment
1	[SHIFT] [PGM]	PGM            DEG 0.	Set to program mode
2	[SHIFT] [[x]]	PGM            DEG [1]	Specify variable (1)
3	[5] [0] [0] [0]	PGM            DEG 5000.	Enter value
4	[x]	PGM            DEG 5000.	Enter operation
5	[ ( ) [1] [+] ] [SHIFT] [[x]]	PGM            DEG [2]	Specify variable (2)
6	[6]	PGM            DEG 6.	Enter value
7	[ ÷ ]	PGM            DEG 6.	Enter operation
8	[1] [0] [0]	PGM            DEG 100.	Enter value
9	[ ) ]	PGM            DEG 1.06	Enter operation, show result
10	[X <sup>y</sup> ]	PGM            DEG 1.06	Enter operation
11	[SHIFT] [[x]]	PGM            DEG [3]	Specify variable (3)
12	[7]	PGM            DEG 7.	Enter value
13	[=]	PGM            DEG 7518.151295	Enter operation

14	[SHIFT] [PGM]	DEG 0.	
15	[RUN]	DEG [1]	Specify variable (1)
16	[1] [0] [0] [0]	DEG 1000.	Enter value
17	[RUN]	DEG [2]	Specify variable (2)
18	[10]	DEG 10.	Enter value
19	[RUN]	DEG [3]	Specify variable (3)
20	[5]	DEG 5.	Enter value
21	[RUN]	DEG 1610.51	Show result